

**AMENDMENTS TO THE CLAIMS:**

Please cancel without prejudice claims 1-26 and 39-41, amend claims 27-38 and 42 and add newly written claim 43 as follows.

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 – 26 (Cancelled)

27. (Currently amended) A laser stabilisation apparatus ~~(70)~~ for stabilising the output frequency ~~(42)~~ from a laser source of radiation ~~(43)~~ ~~having a frequency~~, the laser stabilisation apparatus comprising,

a frequency discriminator apparatus ~~(60)~~ comprising input means ~~(41)~~ for receiving a primary optical input ~~(42)~~ from the laser ~~(43)~~ and for producing two primary optical outputs ~~(52, 53)~~,

means ~~(50, 51)~~ for introducing a relative delay between the two primary optical outputs ~~(52, 53)~~ and,

an optical phase detector ~~(1;30)~~, wherein the optical phase detector ~~(1;30)~~ comprises

means ~~(2)~~ for receiving the two primary optical ~~inputs~~ outputs ~~(52, 53)~~ and producing two combined optical outputs ~~(11, 12)~~,

detection means ~~(32)~~ for detecting the intensity of each of the two combined optical outputs ~~(11;12)~~ and converting the intensity of each of the combined optical outputs ~~(11;12)~~ into an electrical signal, and

means ~~(6)~~ for measuring the difference between the two electrical signals and generating an output difference signal ~~(20)~~,

~~the laser stabilisation apparatus further comprising~~ feedback means ~~(72, 74)~~ for feeding back the output difference signal ~~(20)~~ from the optical phase detector ~~(1; 30)~~ of the frequency discriminator ~~(60)~~ to the laser ~~(43)~~.

28. (Currently Amended) The laser stabilisation apparatus ~~(70)~~ of claim 27 comprising at least one or more additional frequency discriminator apparatus ~~(60)~~ ~~as in claim 19~~, each frequency discriminator apparatus having corresponding feedback means ~~(72, 74)~~ for feeding back the electrical output from the associated optical phase detector ~~(1; 30)~~ to the laser ~~(43)~~.

29. (Currently Amended) The laser stabilisation apparatus ~~(70)~~ of claim 28, wherein the outputs from the optical phase detectors ~~(1;30)~~ of the different frequency discriminators feed back to different control points on the laser ~~(43)~~.

30. (Currently Amended) The laser stabilisation apparatus ~~(70)~~ of any of claims 27-29, wherein the optical phase detector includes a voltage-controlled electro-optic

phase modulator ~~(35; 80)~~ for modulating the phase of one of the primary optical outputs which is input to the optical phase detector ~~(30)~~, the electro-optic phase modulator ~~(35; 80)~~ having a substantially linear response.

31. (Currently Amended) The laser stabilisation apparatus ~~(70)~~ of any of claims 27-29, including a differential amplifier ~~(82)~~, the output from the optical phase detector ~~(1; 30)~~ being fed back to an input of the differential amplifier ~~(82)~~, the output from the differential amplifier ~~(82)~~ being fed back to the laser.

32. (Currently Amended) The laser stabilisation apparatus ~~(70)~~ of any of claims 27-~~31~~29, wherein the optical phase detector ~~(1; 30)~~ forming part of the laser stabilisation apparatus comprises coupling means ~~(2)~~ for receiving the two optical inputs ~~(3, 4)~~ and producing the two combined optical outputs ~~(11, 12)~~.

33. (Currently Amended) An optical frequency synthesizer comprising;  
the laser stabilisation apparatus ~~(70)~~ of claim 27 for stabilising an output from a laser, and  
means ~~(80; 82)~~ for varying the frequency of the laser output.

34. (Currently Amended) The optical frequency synthesiser of claim 33, including two optical fibres ~~(50,51)~~ for introducing a relative delay between the two primary optical outputs ~~(52,53)~~, the two optical fibres having different optical path lengths.

35. (Currently Amended) The optical frequency synthesiser of claim 34, comprising an electro-optic phase modulator ~~(80)~~ arranged in the path of one of the lengths of optical fibres ~~(50,51)~~, whereby application of a SAWTOOTH-like voltage waveform to the electro-optic phase modulator ~~(80; 35)~~ gives rise to a variation of the frequency of the laser output.

36. (Currently Amended) The optical frequency synthesizer of claim 35 and further comprising a voltage source, providing a SAWTOOTH-like voltage waveform, for applying a voltage to the electro-optic phase modulator ~~(80; 35)~~.

37. (Currently Amended) The optical frequency synthesiser of claim 33, comprising a differential amplifier ~~(82)~~, the output from the optical phase detector ~~(1;30)~~ being fed back to an input of the differential amplifier ~~(82)~~, the output from the differential amplifier ~~(82)~~ being fed back to the laser.

38. (Currently Amended) The optical frequency synthesiser of claim 33, wherein the optical phase detector ~~(30)~~ includes an electro-optic modulator ~~(35; 80)~~.

39-41. (Cancelled)

42. (Currently Amended) A method of stabilising the output frequency-(42) from a laser (43) ~~having a frequency~~ comprising the steps of;

providing a frequency discriminator apparatus-(60) comprising input means-(41),  
inputting a primary optical input-(42) from the laser-(43) to the input coupling means and producing two primary optical outputs-(52, 53),  
introducing a relative delay between the two primary optical outputs-(52, 53),  
inputting the two primary optical outputs to an optical phase detector-(1; 30),

comprising

coupling means (2) for receiving the two optical inputs-(3, 4) and producing two combined optical outputs-(11, 12),

detecting the intensity of each of the two combined optical outputs-(11, 12);

converting the intensity of each of the combined optical outputs-(11, 12)

into an electrical signal,

measuring the difference between the two electrical signals and generating an output difference signal-(20), and

feeding back the output difference signal (20) from the optical phase detector (1) of the frequency discriminator-(60) to the laser-(43).

43. (New) A laser stabilisation apparatus for stabilising the output frequency of a laser comprising:

an input waveguide,

a beam divider having an input and first and second outputs, the input waveguide in optical communication with the input to the beam divider

first and second waveguides in optical communication with the first and second outputs respectively, the first waveguide being comprised of an optical delay means

a beam combiner having first and second inputs and two outputs, the first and second waveguides being in optical communication with the first and second inputs of the beam combiner, respectively,

two detectors, each detector receiving radiation from a different output of the beam combiner, the output of each detector being connected to a differential circuit, and

laser feedback means responsive to the differential circuit.